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charges with battle-axes—beat and all but destroyed a million veteran troopers that had swept through the eastern provinces of the Roman Empire like a conflagration through a sun-parched grain field. Sicily was colonized by the Normans—cousins of the same all-conquerors that vanquished King Harold after his victory over the Danes.

"Gentlemen, you are in, and we are out," said an old Moorish sheik when he was forced to embark his followers at Palermo, "and you will stay till the consequences of your vices invite a race of stouter invaders"—but the sweltering climate alone did its work so thoroughly that the next conquerors did not think it worth their while to expel the groveling survivors.

But the settlers of Northern Texas and Northern Mexico have been actually improved by their removal from a higher to a lower latitude, and even from a land of cooler to a land of warmer summers. The "average temperature" of the Rio Grande Valley is warmer than that of Spain or any other part of Western Europe, but the coldest north storms are so much colder that the short winter enables the settlers to accumulate a reserve fund of vigor for the rest of the year. The Mexican states of Chihuahua and Tamaulipas breed *vaqueros* that can run our toughest cowboys a close race in rough-riding and tricks of wild daring, and would rout modern Spanish infantry as the Spaniards of Balboa routed the natives of the Central American coast regions. The dominant race of modern Texas and Arkansas is composed of British, French and German immigrants and their descendants, and between the Arkansas River and the Rio Grande six-footers are now far more numerous, per thousand inhabitants, than in any part of Germany, France or Great Britain.

But further south, that contrast is suddenly reversed; in the perpetual summer climate of Southern Mexico and the Southern West Indies the Creoles have degenerated beyond any South European degree of degeneration, and the difference between the *Indios Bravos* (Apaches, Yaquis, Comanches, etc.) of the North Mexican border and the *Indios Mansos* of the South, is as great as that between the Arab tribes of Mount Atlas and the Egyptian Fellahs.

The extreme southern limit of the blizzard-range, in fact, marks a sanitary division line almost as unmistakable as that of the European Alps.

The much-maligned snow-tornadoes that traverse a bee-line route equalling the distance from northernmost Norway to the center of the Sahara, should be recognized as one of the chief blessings of our continent; the yearly visit of nature's microbe-killer prevents countless diseases and nips countless others in the bud; and, like the first British colony of Tasmania, several of our Southern States might specify their inducements to immigrants: free land, free fuel and free medical attendance.

F. L. OSWALD.

SHEATHING WARSHIPS.

THE question of copper sheathing our naval vessels is one that constantly comes to the surface in emergencies like the present. Nearly all of our modern yachts built of wood are sheathed with copper, and so are many of the sea-going tugs and wooden merchant vessels. The operation is an expensive one, but in the end it is questionable whether the results do not justify the extra outlay. The navies of the world have been interested in the subject for a long time, and copper was applied to sheathing war vessels as far back as 1761, and nearly every other anti-fouling substance imaginable has been experimented with at various times. From 1620 to 1770 the Colonial and English shipbuilders used lead as a sheathing material, and they nailed it on the wooden bottoms of their ships with large copper nails. Later, a mixture of tar, pitch, and brimstone was applied to the bottoms to protect the ships from the barnacles and teredo.

But England made the first attempt to sheath vessels of the modern iron and steel navies in 1868, when the iron cruiser "Inconstant" was prepared for service in warm seas. She had her bottom completely sheathed in copper, and she proved so successful that between that date and 1889 thirty-two other vessels of the English navy were copper-sheathed. The process adopted then was a little crude compared with present-day methods. The bottom was what is called flush-plated, with heavy seam straps on the outside. Since 1889 the British Admiralty has made it a practice to copper-sheath every war vessel intended for foreign waters where docking facilities were poor, and the result is England has a large fleet of copper-sheathed cruisers that could stay in tropical waters for a long period without becoming badly fouled.

In our navy, copper-sheathing of the new vessels has had its advocates, but little has been done in a practical way in this direction. When the first members of the White Squadron, the "Chicago," "Boston," "Atlanta," and "Dolphin," were built, the Naval Advisory Board considered the question of copper-sheathing their bottoms, but it decided adversely. It was estimated then that it would cost $75,000 to sheath the "Chicago" and a little less for the others. The decision then reached established a precedent that has been difficult to overcome.

There were two other important objections to performing the work besides that of expense, and the Naval Advisory Board at that time justified their decision, which has had such a far reaching effect ever since. One was that the copper-sheathing would add enormously to the weight of the cruisers, and thus reduce their speed. In the case of the "Chicago" it was estimated that the additional weight would be about 255 tons, and 160 tons each for the "Boston" and "Atlanta." The second consideration was that the process of copper-sheathing was far from perfection, and that it was barely beyond the experimental stages. A slight derangement or scratch of the copper plates might at any time expose the steel hull to great danger. Galvanic action might begin instantly, and do considerable damage before the ship could be docked. As an instance of what damage can be created in this way on short notice mention should be made of the cruiser "Cincinnati." She anchored alongside of a copper-sheathed vessel at her moorings, and as a result her bottom was seriously injured. It is a strict order in the navy now that an unsheathed vessel is never to anchor alongside of a sheathed steamer of any kind.

Copper sheathing is not a perfect anti-fouler, and consequently experiments are being made continually with paints and compositions to preserve the hulls of our warships. Some curious substances are tried for this work, and the results are of historical interest if not of exact scientific value. The Japanese, for instance, startled the navies of the world by announcing a number of years ago that they had discovered the great sheathing material for the future. This was nothing more than Japanese lacquer prepared in a certain way. A lacquer manufacturer of Tokio made experiments in covering steel plates with his lacquer, and these were submerged in salt water for many months. The condition of the plates after they were recovered seemed to justify further experiments, and the steamer "Fuso-kan" was docked, and part of her bottom sheathed with the lacquer. Immediately after an examination of her hull a year later, the Japanese Admiralty ordered a cruiser to be treated by this process, and the European nations, not to be left behind in the game, followed suit. The Russian Government had the warships "Dmitri Donskoi" and "Admiral Nachimoff" lacquered in 1890, and the United States naval authorities took cognizance of the new invention in 1891. In that year the Japanese lacquering company sent over steel plates treated with the new preservative, which were submerged at the Norfolk Navy Yard and taken up three months later. Nothing, however, was done by our Government to adopt this method of preserving our warships from fouling, and for various reasons the Japanese process of lacquering warships' bottoms has not made much advance in the European navies.

All of the governments have fallen back upon copper, or compositions in which copper is the predominant metal, for sheathing their warships. Electroplating the bottoms of ships with copper has recently been experimented extensively with, and this does away with many of the old objections to copper sheathing. Where the copper plates were nailed on the ships, "pitting" nearly always started at the nail holes. If the salt water was allowed to enter here even in the smallest quantity, corrosion would begin at once, and in a short time do great damage to the steel hull. In electroplating, however, the copper sheathing is put on in one unbroken mass, and there is no danger from "pitting." When the whole surface has been electroplated with copper a smooth and unbroken surface is presented, and it fits so closely that the sheathing cannot be removed without sometimes chipping off the iron. Moreover, this sheathing is merely a light film of copper, and its weight is so small that it averages only 2.85 pounds to the square foot.

While copper sheathing is not a perfect anti-fouling material, it is so satisfactory that ships with their bottoms so treated can often remain in warm seas for two years without being docked. Ordinarily an unsheathed vessel could not remain in such waters more than six months without having its bottom so covered with barnacles that its speed would be seriously reduced. Copper sheathing not only gives a smooth surface which offers no friction to the water, but the barnacles are killed by the poison from the copper. The small marine animals attach themselves to this copper surface and absorb the poison, which kills them and makes them drop off. This poison is produced by the gradual dissolution of the copper by coming in contact with the salt water. The chemical process in time ruins the copper bottom, and if it does not dissolve fast enough the marine animals secure a good foothold on it. All of the anti-fouling paints and compositions imitate the action of copper. Most of them are composed of copper, mercury, zinc, or arsenic. Next to copper, zinc has been used more commonly in European navies than any other metal, but this does not act as well in salt water as copper, and its use is gradually dying out.

G. E. WALSH.

LABOR-SAVING DEVICES IN LITERARY WORK.

IN approaching the question as to what has been done by literary men to lighten the mechanical side of their labors, we are struck with their lack of progress. The reasons for this deficiency are two-fold; the literary man is not a mechanic, and he believes this side of his work to be beneath his